



*“Reversing Environmental Degradation Trends
in the South China Sea and Gulf of Thailand”*

SEAGRASS DEMONSTRATION SITES IN THE SOUTH CHINA SEA



UNEP/GEF
Regional Working Group on Seagrass





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Cover Illustration: Google Earth Image of the South China Sea showing the location of the four seagrass demonstration sites.

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Hepu Seagrass Demonstration Site

The Hepu seagrass demonstration site is located, in Guangxi Province, People's Republic of China, at 21°28.5' North, 109°40.2' East. The total area of seagrass in 2003 was 540 hectares (Figure 1) divided into seven beds in coastal areas adjacent to Shankou and Shantian towns.



Figure 1 Location of the Seven Seagrass Beds Surveyed during 2002 and 2003.

There are 4 seagrass species: *Halophila ovalis*, *Halodule uninervis*, *Halophila beccarii* and *Zostera japonica*. *H. ovalis* is the dominant species occupying 75% of the whole seagrass area and having a percentage cover of more than 80%. The average biomass is 25.5g/m²; and the density is 1,385 shoots/m². Associated fauna and flora reported in the Hepu seagrass bed include 5 penaeid shrimps, 12 gastropods, 1 seahorse species, a number of species of urchins, siganids, holothurians, and starfish. Less common are the green turtle (*Chelonia mydas*), dugong (*Dugong dugon*), and Indo-Pacific hump-back dolphin (*Sousa chinensis*).

In Shankou, the population in 1999 was 65,881, of whom 42,677 work in the agricultural sector in a land area of 2,267 hectares. In Shantian, the population in 1999 was 16,387 with a labour force of 7,795 people working in the cultivation of 535.6ha. The local population of Shankou and Shantian are primarily dependent upon rice cultivation and fish culture.

Current management of the area is the responsibility of two separate entities. The Shantian Town Government has management rights to the sea area. The National Nature Reserve for Dugong, which is under the jurisdiction of the Guangxi Province Environmental Protection Bureau, has the duty to protect dugong and seagrass.

Threats to seagrass include natural threats such as storms and strong waves, and human induced threats, which include gleaning, trampling, digging for *Sipunculus nudus* (acorn worms) and shellfish, cage culture of oysters, fish fences, trawling, and waste water pollution. Of these mariculture is perhaps of greatest importance, particularly the extensive construction of fish pens.

The goal of the project is to demonstrate community based management, aimed at maintaining existing biodiversity and environmental condition and using seagrass resources rationally and sustainably. This is to be accomplished through maintaining a balance between utilisation and conservation, based on community and government involvement.



Figure 2 Panoramic View of the Extensive Hepu Seagrass Bed at Low Tide.

The Hepu demonstration site aims to:

- Establish a cross sectorial management framework for the sustainable use of the seagrass site;
- Manage the site sustainably;
- Conserve the seagrass ecosystem as a major habitat for the purpose of biodiversity conservation, dugong protection, etc.; and
- Educate and involve all stakeholders with regard to the preservation of seagrass habitat.

Key achievements to date:

A key achievement of the seagrass component in China to date has been the enhanced awareness of the importance of seagrass meadows as spawning and nursery areas for demersal fish and crustacean species. The website <seagrass.scsio.ac.cn> is the only website in China carrying information regarding seagrass and has been an important tool in sensitising senior government officials to the importance of seagrass ecosystems.

The Management Board for the Hepu Seagrass demonstration site, with a membership of twelve people from various government sectors, was established in 2004 and has operated smoothly with regular meetings every 3 months. The Management Board is responsible for oversight of the implementation of the demonstration site activities and for the development of policies and the overarching management plan. The board has been an effective mechanism for ensuring cross-sectorial co-ordination that has resulted in a multi-agency task force of local government bodies, fishermen, residents and students, being formed to physically remove the posts and structures supporting illegal mariculture pens and fences (Figure 3). The first action for enforcement covered an area of

1,100 hectares and involved the mobilisation of more than 300 people and 12 vessels. This resulted in the removal of more than 50,000 illegal wooden posts and 1 shelter, and cleaned 13 illegal mollusc culture areas.



Figure 3 Removal of Posts used in Illegal Fish Cage Culture in the Hepu Seagrass Bed.

A management plan has been developed and reviewed by the Management Board and will be approved by the local government for implementation during and beyond the life of the project in order to maintain project outcomes. Part of the management plan includes a draft zoning framework in which 200 of the 300 hectares of seagrass are classified as a sustainable use zone. A National Seagrass Nature Reserve will be established in Hepu by mid-2008. The central government will provide permanent annual budget allocations to maintain activities of the reserve, thus ensuring financial sustainability.

A re-evaluation of the existing criteria and a draft work plan to expand the National Dugong Reserve has been finalised to cover a wider area of habitat for this endangered species. Legislation to support the management of Hepu seagrass was developed and reviewed by the Management Board and will be approved by the local government as a basis for more effective enforcement of management regulations in the future.

Water and sediment quality have been monitored at seven monitoring stations by the staff of the Management Station of the Hepu Nature Reserve. Water temperature, transparency, pH, salinity, and data for other chemical attributes have been collected.

In order to assess the status of seagrass beds in Hepu, an ecological survey was carried out at 6 areas (Xialongwei, Shabei, Beimu, Yingluo Port, Ronggen Hill and Jiuhejingdi) in August 2006. This seagrass watch revealed that the degradation trend in Hepu seagrass beds is still serious. The impacts of human activity in Shabei and Xialongwei are obvious. Digging for *Sipunculus nudus*, *Phascolosoma esculentus* and shellfish occurs in most areas, and is considered as the main cause of seagrass degradation in terms of reduced cover.

A second survey in October 2006 focussed on the collection of data and information relating to the economic valuation of seagrass habitat in Hepu. The outputs from these surveys have been used by policy-makers in developing plans for sustainable use of seagrass resources.

Regarding capacity building, 20 persons have been trained on seagrass survey techniques and a number of items of equipment used for underwater surveys and monitoring of water quality have been purchased by the project.

Diverse activities have been carried out to enhance public awareness of the importance and value of seagrass including the publication and distribution of a small book, 500 posters and brochures, and 400 copies of a video on protecting seagrass ecosystems and preserving marine biodiversity. A book has been published providing an introduction to the ecological functions and importance of seagrass, and provides guidance to local people on how to protect and sustainably use their seagrass resources. This book also contains the phone number for reporting illegal activities in the area. The project has convened three training courses for teachers and pupils on ecological function and economic value of seagrass; current status of the Hepu seagrass bed; and measures for conservation and sustainable use.

The effectiveness of this programme has been assessed by the conduct of surveys and the evaluation of members of the public and government officers' awareness of various aspects of seagrass ecology and management every three months. The results suggest that levels of awareness have greatly improved since project inception. More importantly, the designation of the Hepu seagrass bed as a demonstration site under the UNEP/GEF Project has resulted in the agreement of Government authorities to fund the costs of construction of a seagrass education and information centre. Designs have been finalised by the Tianjin Construction Design Institute and construction will be completed in 2008.

It is recognised that the execution of the Hepu demonstration site still has minor weaknesses, which need to be addressed. Representatives of the local community, private sector and NGOs have not yet been included as members of the Management Board. As a consequence activities at the demonstration site have not involved the private sector and NGOs, which may have resulted in missed opportunities for the mobilisation of additional financial and human resources. Approval of the management plan for the Hepu demonstration site has been delayed by the local government which has delayed the implementation of some activities.

- Develop and implement a long-term management plan including regulations for sustainable use of seagrass resources and ecosystems;
- Enhance public awareness and to improve understanding among policy-makers, managers and local communities of the ecological significance and economic value of seagrass habitats; and
- Investigate possible mechanisms for ensuring financial sustainability of management and improving the economic conditions of coastal communities.

Key achievements to date

The first and most important achievement has been the establishment of two multi-sectorial and multi-level management bodies for supervising and guiding the implementation of the demonstration site activities. The Management Board (MB) and Management Advisory Group (MAG) are comprised of members of relevant public sector organisations at national and provincial levels and are responsible for dealing with political (MB) and scientific (MAG) matters, and were established by provincial declaration in October 2006. These management bodies convene regular meetings, both separately and jointly, every three to six months in order to track progress and to guide the implementation of activities. They also have a primary responsibility to develop a long-term management plan based on sound scientific data and information.

As the Kampot demonstration site lies in close proximity to the Phu Quoc Island seagrass and coral reef demonstration site in Viet Nam, (see Figure 1) the Management Board and Management Advisory Group have a responsibility to co-ordinate their work with partners in Phu Quoc. Two joint meetings have been convened between the Management Boards of both sites to date. A co-operative framework for ecosystem and resource management has been drafted for review and adoption by both provincial authorities. Technical experts from both sites have agreed the format and parameters to develop a joint GIS database to support planning and management that will be finalised during project implementation.

At the request of the Kampot Management Board, Viet Nam has developed practical guidelines for resource assessment and monitoring and has conducted a training course in support of activities at Kampot. Representatives of the Kampot authorities and communities have visited Phu Quoc in order to learn from the experiences of their Vietnamese counterparts in the management and conservation of seagrass resources. The guidelines focus only on seagrass and physical environmental conditions, but not on associated resources and socio-economic indicators. The latter need to be developed in order to track changes that result from management actions.

Since data and information concerning the seagrass community at the Kampot demonstration site is very limited, collection of biological and socio-economic data and information at the site level is crucial in order to establish baselines against which the impacts of future developments can be measured, and the effectiveness of long-term management evaluated. Biological data relating to: seagrass species distribution, density, and canopy height; and socio-economic data on: resource uses, income of local communities and fishers, and economic values of seagrass resources have been collected through extensive surveys. These data will be incorporated into the GIS database and used in the establishment of zones for different uses within the management plan.

Capacity building commenced with a training course on project management and administration for officers involved in executing activities at the site. Five local consultative workshops have been convened to enhance public awareness regarding the value of seagrass and the need for conservation. In addition, public awareness has been enhanced by the distribution of 2,000 posters and 5,000 leaflets describing seagrass resources; the functions and values of seagrass ecosystems; and the concepts of sustainable management and conservation. These have been published and distributed to all relevant stakeholders, especially local schools, pagoda and communities.



Figure 6 5,000 Seagrass Posters have been Distributed through, Schools, Pagoda and Government Offices.

Even though a considerable volume of outputs have been produced to date, management is still weak and further action is required. One of the most crucial outputs, the management plan for the demonstration site, has not been finalised or approved and this remains to be completed in the near future. Management practices need to include future monitoring with involvement of local people to assess if management of seagrass resources has been effective as a consequence of the demonstration site activities.

Bolinao Seagrass Demonstration Site

Cape Bolinao is located on the north western tip of Pangasinan Province (16°36' – 16°46' North and 119°83' – 119°97' East) and is surrounded by the most extensive coral reef in the Lingayen Gulf. It lies on the western margin of the Lingayen Gulf facing the South China Sea to the North and West and the Caquiputan Strait to the East. One large island, Santiago Island and several smaller ones are located adjacent to Cape Bolinao (Figure 7).

Santiago Island is an integral part of the Lingayen Gulf system as a consequence of its' extensively developed reef system and associated habitats. The reef flat area is estimated at around 50km² of which half the area (~25km²) supports extensive seagrass meadows. There are seven seagrass species recorded from Santiago Island and Cape Bolinao. Giant clams (*Tridacna gigas*) have been over-exploited in the area and a giant clam hatchery and nursery was developed at the Marine Science Institute marine station with grow-out areas on Santiago Island.

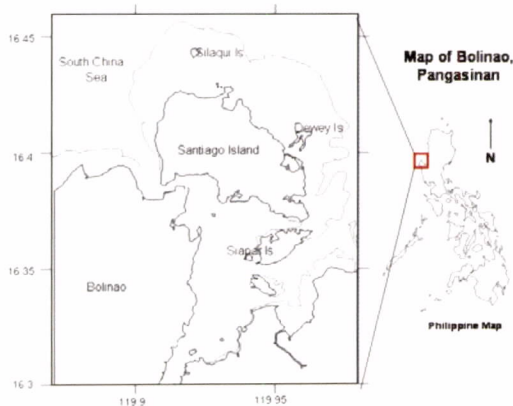


Figure 7 Location of Bolinao in Northern Luzon, Philippines.

Preliminary surveys have recorded a number of species including: 10 species of holothurians, 11 crustaceans, 1 starfish, and 149 gastropods. The reef flat, and in particular the seagrass beds, are identified as critical spawning and nursery habitat for juvenile rabbitfish and sea urchins. Rabbitfish (*Siganus fuscescens*) juveniles migrate from open sea to the seagrass areas to seek refuge and food while sea urchins (*Triploneustes gratilla*) remain within the bed to forage throughout their life-cycle.

Of the 30 *barangays* (the smallest local government unit in the Philippines) found in Bolinao, 20 are located in coastal areas and 22% of the total population is engaged in fishing. Based on present use, the coastal waters of Cape Bolinao are divided into four zones; a fishery management zone for use by subsistence fisher folk; a multiple use zone; a trade and navigational zone; and an eco-tourism zone.

Forty four percent of the population is engaged in fishing and forty one percent in agriculture. The

remaining fifteen percent derive income from collecting shells for shell craft, charcoal making, small businesses, and salaried employment. There are about 3,000 people who are totally dependent on fishing for food and income. Only 37% are full-time fishermen, 43% are part-time fishermen and 20% are engaged in fish processing and related business, and small-scale mariculture activities. Fish are sold by the fisher folk wholesale, retail and by house-to-house peddling. Milkfish aquaculture in Bolinao has now become the major source of cash income for the local community, but tourism is growing rapidly.

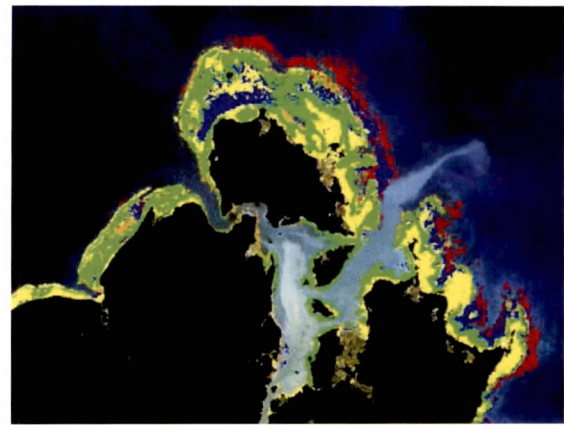


Figure 8 False Colour Image of the Bolinao Reef System. Red is Coral Reef, Yellow Bare Sand, Green Seagrass and Blue Mixed Habitats.

The main threats to the marine environment at Bolinao come from pollution by household wastes and from cage mariculture, the clearing of mangrove areas for fish ponds, catching siganid juveniles in seagrass using push net, trampling of seagrass beds and reef flats.

This demonstration project aims to establish functional linkages between and among community groups, academic institutions, and local and national government entities, such that the seagrass ecosystems that form the resource base of local livelihoods will be enhanced, protected and managed. In addition, the aim is to preserve the biodiversity in the seagrass meadows, marine fauna and flora alike, restore the degraded areas, and reduce threats and provide preventive actions to these threats.

The objectives of the demonstration site are to:

- Enhance resource management, particularly for seagrass based on comprehensive data and information;
- Intensify and increase public awareness through an information, education and communication campaign;
- Strengthen stakeholders' capacity in management of resources; and
- Design and implement an alternative, and/or supplemental livelihood programme.

Key achievements to date:

The establishment and operation of the Management Board has created a functional linkage between stakeholders, and ensures policy-making in the context of a multi-sectorial approach. The Board conducts regular meetings to draft and consider elements of a Bolinao Seagrass Reserve Management Plan and to prepare an Ordinance for the establishment of the Bolinao Seagrass Reserve. A Memorandum of Agreement encompassing partnership amongst and between the Bolinao Local Government, the Bolinao Marine Ecological Fund Foundation, Marine Science Institute and the Bolinao Seagrass Demonstration Site has been signed to enhance co-ordination in marine resource management.

A database of seagrass resources at the Bolinao demonstration site has been established, encompassing both biological and socio-economic data and information. A map of seagrass resources has been prepared on the basis of field survey data and this will be integrated into a GIS database. On the basis of data and information obtained through the field surveys, a Bolinao Seagrass Sanctuary with the total area of 60ha has been established divided into a 20 hectare core zone and a 40 hectare of buffer zone. Eleven permanent seagrass monitoring sites have been established in different areas, five on Santiago Island and six in coastal barangays on the mainland. To operate the Bolinao Seagrass Sanctuary, an ordinance was approved by the Office of the Municipal Council in March 2007. The Management Plan was developed and finalised in July 2007.

A series of activities have been carried out to enhance public awareness, including: convening of a project orientation workshop; dissemination of information on seagrass distribution obtained from the field surveys; preparation and distribution of awareness materials including billboard, comics, seagrass T-shirts, and a video. Local newspapers and TV have interviewed project participants and have broadcast information on the activities and successes of the Bolinao site. The Seagrass Festival, named "Tarektek" was initiated during the Bolinao Town Fiesta in April 2007. The Bolinao demonstration site was highlighted during this festival by means of a float in the parade, and the distribution of awareness materials to the public.

Two training courses have been organised one on seagrass taxonomy (50 trainees) and one on waste management (64 trainees). A study tour for committee members was also organised to Puerto Princesa City, Palawan. In addition, training on "Seagrass Watch" methods was organised for volunteers including fisher folk, *barangay* officials and local government personnel. The training events covered techniques for monitoring and assessing seagrass meadows. The training and mobilisation of local police and "*Bantay Dagat*" volunteers was intended to strengthen enforcement of Municipal Ordinances related to the management of coral reefs, mangroves and seagrass.

A significant achievement has been the support from the project to enhance the quality of the local *danggit* (*Siganus spp.*) product in terms both of quality and packaging. This has more than doubled the original price of the product and raised its' acceptability. It was noted during the mid-term evaluation that large quantities of juvenile rabbit fish are used to produce the "*danggit*". According to information from meetings with villagers and local community officers, it seems that there is a lack of biological and catch information such that an analysis of the biology, species composition, life-cycles, spawning season and area, and catch records should be undertaken as a matter of priority. Other alternatives to improve local livelihood and to reduce threats to seagrass and associated habitats include the culture, harvesting and marketing of sea cucumbers.



Figure 9 Seagrass Float for the Bolinao Town Festival, 2007.

The efforts of the local government in the conservation of coastal habitats are significant and worthy of special note. The Mayor of Bolinao Municipality has promulgated a series of Municipal Ordinances to establish a number of small-scale marine protected areas or sanctuaries, including 8 for coral reefs, 8 for mangroves, and 1 for seagrass. A system of "*Bantay Dagat*" (Sea Wardens) has been established in order to enforce these ordinances. The sea wardens are fishermen from coastal villages and the local government provides them with a patrol boat and daily allowance.

The of Bolinao demonstration site has focussed on implementation of activities such as networking, development of local ordinances, meetings and training. Few practical activities have been undertaken to date. Practical activities at the site level are considered urgent if the demonstration site is to achieve all expected outcomes.

Activities involving the implementation of Seagrass Watch and assessment of the socio-economic impacts of the municipal ordinance need to be initiated as soon as practical. In this regard a large amount of information and data collected by "*Bantay Dagat*" members should be documented as these include potential indicators of value in monitoring changes to resources in the area.

East Bintan Seagrass Demonstration Site

Bintan Island is the largest, (1,591km²) of 3,200 islands in the Kepulauan Riau Province of Indonesia. It is located about 810km northwest of Jakarta (Figure 10). The Census in 2000 showed that 45,495 males and 48,200 females were resident in 11,960 households of East Bintan giving a density of 59 people km⁻². The majority of the local people are engaged in agriculture and fisheries although some are employees in coastal resorts, which is a rapidly expanding source of employment in the area.



Figure 10 The Riau Archipelago, Indonesia.

East Bintan is rich in biodiversity and its' seagrass habitats have a high density with seagrass cover of up to 95% providing refuges and spawning areas for a wide variety of marine species. There are ten species of seagrass found in the area of Trikora Beach: *Enhalus acoroides*, *Thalassia hemprichii*, *Cymodocea rotundata*, *Cymodocea serrulata*, *Thalassodendron ciliatum*, *Halodule pinifolia*, *Halodule uninervis*, *Syringodium isoetifolium*, *Halophila ovalis*, and *H. spinulosa*. These form both non-specific meadows and mixed associations. *Thalassodendron ciliatum*, *Enhalus acoroides* and *Thalassia hemprichii* have been recorded as the most common species that are widespread throughout the area. The most significant seagrass species in the area is *Halophila spinulosa* since it is rare in Indonesia.

Coral reefs are well developed along the southern and eastern coasts, and live coral coverage in the reef edge of this area is fairly high (40-70%), dominated by massive coral genera such as *Porites*. Approximately 70 species of reef fishes have been recorded. Mangroves are found in the northern part of Trikora Beach around the Tanjung Berakit area. Endangered and threatened species include the dugong (*Dugong dugon*), sea horse (*Hippocampus* sp.), green turtle (*Chelonia midas*), and hawksbill turtle (*Eretmochelys imbricata*). Species considered nationally endangered include the giant clams, *Tridacna squamosa* and *Tridacna crocea*, and top shell, *Trochus niloticus*. The island has beautiful, scenic beaches along the northern coast where tourism development is concentrated.

There are 31 commercial fish species reported from the site, among them the spotted coral and leopard groupers (*Plectropomus maculatus* and *Plectropomus leopardus*) are of transboundary significance. It is reported by local experts that the juveniles of coral groupers, *Plectropomus* spp. are often found in coral reefs adjacent to Trikora Beach. Shrimp species of economic importance associated with this site include: banana prawn, *Penaeus merguensis*, giant tiger prawn, *Penaeus monodon*, jinga shrimp, *Metapenaeus addinis*, and greasyback shrimp, *Metapenaeus ensis*.



Figure 11 The East Bintan Seagrass Demonstration Site.

Due to the geographical location of the site, which is close to Tanjung Pinang, Batam City and even closer to Singapore, Bintan Island is under heavy development pressure and resource exploitation is increasing. The island is currently undergoing rapid development due to strong demand for resort development as well as high demands for construction and reclamation materials, such as rock, soil and sand, which are exported to Singapore. The provincial and local authorities face the challenge of simultaneously conserving the seagrass and associated habitats whilst at the same time strengthening local economic development.



Figure 12 Sand Mining for Export Causes Increased Turbidity and Loss of Seagrass Habitat.

Observed problems at the site include degradation of the seagrass beds and a decrease in fish resources resulting from physical changes to the seabed, such as sand removal, and enhanced sedimentation and siltation, in areas where coastal construction is being undertaken which reduce the area and vegetation cover in the seagrass beds. Increased turbidity adversely affects the photosynthetic capacity and growth of seagrass whilst increased organic and nutrient pollution have resulted in enhanced growth of epiphytic algae.

Further direct threats to the seagrass habitats include destructive fishing methods such as trawling and push netting. Without effective and integrated interventions, the degradation trends in this regionally significant seagrass habitat will accelerate with resultant loss of biodiversity.

This medium sized project aims to establish an integrated management system for a total of 1,500 hectares of the coastal and marine environment including seagrass and associated habitats, through a cross-sectorial and participatory approach to addressing the threats, and the root-causes of current and future habitat degradation. The project plans to achieve three major outcomes, which will create an environment, among all stakeholders, for enabling and maintaining sustainable management of the area, as follows:

Management of the area is improved through: the establishment of appropriate institutional arrangements to ensure a wide range of relevant stakeholders participate in decision-making, and on-the-ground management activities in particular the local communities and the private sector; adoption of integrated area management plan, and introduction/revision and enforcement of relevant regulations.

Awareness on the importance of seagrass habitats and associated ecosystems are increased; and capacity for seagrass habitat management is improved through: awareness raising and capacity building among all stakeholders in order to increase understanding of the ecological and socio-economic value and importance of seagrass and associated habitats; and application of such knowledge for area management and planning in particular among local government officials and community members who are involved in the area management; and

Environmental sustainability of local economic activities is increased through the creation of an environment for sustainable economic activities such as sustainable tourism and other types of alternative income generation options.

Key achievements to date:

The demonstration site of East Bintan has recently become operational as a medium sized project. A number of activities have already been undertaken with support of local government co-financing,

including field research for economic valuation of seagrass and a study on the tourism potential.

The surveys provided information and data essential for spatial zoning for sustainable use of the seagrass resources in the area. Data on direct uses of fisheries resources such as fish, crab, and shellfish, and on indirect uses such as tourism have been collected. These data suggest an economic value of seagrass in East Bintan of US\$2,287ha⁻¹ year⁻¹, of which tourism contributed the highest values. Capture fisheries involve a greater number of people, 574 households or 2,870 people, compared with tourism, 150 households or 750 people.

The Local House Representative of Bintan has adopted the spatial plan (Perda No. 14/2007) under which four zones are designated: a conservation zone for habitat protection with bans of resort and hotel construction, and permission only for fishing by local communities. Diving, snorkelling, tracking, cycling and camping are arranged in a buffer zone with specific regulations relevant to each activity. General coastal tourism zone requires the development of hotels, resorts, restaurants and real estate and the provision of services for boating, surfing, para-sailing, horse riding and diving. All such activities including construction should be managed in accordance with the relevant regulations to prevent sedimentation, erosion and discharge of domestic waste.

The next step for the Bintan site is the finalisation of a sustainable tourism spatial plan. Since tourism contributes enormously to Bintan's economy, the plan is of critical importance and a draft is under consultation with local stakeholders.



Figure 13 Tourist Accommodation Constructed above a Seagrass Meadow in East Bintan.

Awareness activities have included the dissemination of a set of posters and leaflets on seagrass conservation to local communities and related stakeholders. In addition, the local government have provided 1.5 hectares of land at Trikora beach for development of a marine research and information centre to benefit the local community, governmental entities, and local stakeholders.

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